

New Hampshire Volunteer River Assessment Program

LAMPREY RIVER 1998 - 1999 Water Quality Monitoring Report



Acknowledgements

Many individuals contribute enthusiasm and dedication to the exploration and stewardship of New Hampshire rivers. The New Hampshire Department of Environmental Services extends sincere thanks to the volunteers and supporters participating in the Volunteer River Assessment Program:

- The volunteers give their time and energy toward the monitoring of water quality indicators and characteristics.
- The continued dedication of DES Commissioner Robert W. Varney enables volunteer monitoring support services to be extended across New Hampshire through DES lake and river assessment programs and partnerships.
- The DES Volunteer Lake Assessment Program serves as an overall model for the relatively new Volunteer River Assessment Program (VRAP). The University of New Hampshire Lakes Lay Monitoring Program, Great Bay Coast Watch, River Watch Network and the Merrimack River Watershed Council Volunteer Environmental Monitoring Network provide a wealth of experience and guidance for VRAP.
- The local organizations including Conservation Commissions, Regional Planning Commissions, schools, and municipal waste and drinking water treatment facilities contributing resources to citizen monitoring are helping to create sustainable citizen monitoring programs.
- A growing number of individuals, organizations, agencies and DES staff support VRAP by participating in monitoring activities, offering suggestions and initiating partnerships.
- The New Hampshire Estuaries Project (NHEP) and the DES Non-point Source, Ambient Sampling, and Source Water Protection programs augment volunteer efforts with funding and organizational support for monitoring projects.
- Senator Judd Gregg, for securing generous funding for VRAP equipment, is recognized as a supporter of volunteer monitoring efforts in New Hampshire and an advocate for natural resource protection.

1998 and 1999 Lamprey River Volunteer Monitors

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Introduction

There are over ten thousand miles of rivers and streams in New Hampshire, stretching through our communities from the Canadian border all the way to the Atlantic Ocean. Healthy water resources are an indispensable part of our existence- we rely on clean water for drinking, recreational use, commercial and industrial supply. We also use surface waters for transportation purposes and as receiving waters for both industrial and municipal waste discharges. The development of land for residential, commercial and industrial purposes places additional pressure on surface waters. The New Hampshire Department of Environmental Services (DES) is charged with evaluating and regulating the quality of our surface waters, and is expanding its role in supporting and standardizing volunteer water quality monitoring to promote environmental monitoring and stewardship.

Since 1985 the DES Volunteer Lake Assessment Program (VLAP) has supported volunteer monitoring of New Hampshire lakes. VLAP volunteers collect water quality information about 130 lakes and ponds in New Hampshire each summer, contributing information about these waters that would otherwise be unattainable. The huge success and popularity of VLAP serves as a model for the Volunteer River Assessment Program (VRAP).

In New Hampshire there are watershed associations, local advisory committees and other established river interest groups sustained in a large part by volunteer efforts. Several of these groups have existing water quality monitoring programs and many have expressed interest in exploring and inventorying local water resources. VRAP (“vee-rap”) was established in 1998 to provide support for these groups in the form of study design aid, technical assistance and training, loans of monitoring equipment, and data warehousing.

VRAP is an education and technical assistance program designed to support and coordinate volunteer monitoring of New Hampshire rivers. The main goals of VRAP are as follows:

- ☞ To educate the public about rivers and water quality;
- ☞ To organize groups to monitor water quality according to their goals;
- ☞ To provide monitoring guidelines, equipment loans, and technical training;
- ☞ To standardize data collection and management; and
- ☞ To report results and recommendations to volunteers.

General River Quality

The State Legislature classifies the New Hampshire surface waters according to what is known about their existing and historical quality and the uses they are required to support. The waters in each classification must satisfy all of the requirements of lower classifications. Currently there are two classes of surface waters in New Hampshire: Class A and Class B. According to the New Hampshire Revised Statutes Annotated (RSA 485-A:8):

“There shall be no discharge of any sewage or wastes into Class A waters, and these shall be considered as being potentially acceptable for water supply uses after adequate treatment.”

Class B waters “shall be considered as being acceptable for fishing, swimming and other recreational purposes and, after adequate treatment, for use as water supplies”.

State water quality officials monitor and regulate surface waters for compliance with the State of New Hampshire Surface Water Quality Regulations, set forth in RSA 485-A:8 and administrative rules Env-Ws 430. The overall goal is that all surface waters attain and maintain specified standards of water quality to achieve the purposes of the legislative classification. The DES Ambient Sampling Program conducts annual water quality sampling of rivers and streams in the state. Ambient samples represent the conditions of the water at the time they were taken and are analyzed for selected chemical and bacteriological parameters. The results are summarized in two reports: the annual DES Ambient Water Quality Report and the biennial 305(b) Report to Congress.

The annual data are presented and analyzed in the Ambient Water Quality Report. The results are used to:

- Evaluate attainment of New Hampshire water quality standards;
- Update baseline data used to determine long term water quality trends;
- Determine the capacity of receiving waters to assimilate waste loading;
- Assess potential toxic impacts;
- Determine the progress of restoration projects and Best Management Practices; and
- Determine if additional sampling is needed or where water quality violations exist.

In the 305(b) Report to Congress, the waterbodies not meeting their legislated classification are listed with the parameter in violation along with the probable source of the violation. This information is used on the federal level to determine where preservation, restoration and further assessment dollars will be spent across the country. Available funding is distributed among the states primarily through the United States Environmental Protection Agency (EPA) and constitutes the major source of funding our state water pollution control agency uses to accomplish water quality evaluation, restoration and preservation activities.

The DES Volunteer River Assessment program was established to augment water quality data collection efforts. VRAP aims to provide a mechanism for accessing local knowledge, creating reverence for water resources and increasing the volume and availability of information about New Hampshire rivers.

Monitoring Parameters

VRAP loans water monitoring kits that include meters and supplies for measuring five basic, or baseline, water quality parameters: water temperature, dissolved oxygen, pH, conductivity, and turbidity. Volunteers are trained to make measurements with these instruments at locations in the river that help pinpoint water quality assets and concerns. Baseline measurements repeated over time create a picture of the natural fluctuations in water quality and help to determine where improvements, restoration or preservation may benefit the river.

The investigation of additional parameters such as nutrients and bacteria is conducted by state water quality personnel and can be pursued by volunteer monitors. Sampling additional parameters comes with the cost of analysis, which can be covered by an assortment of fundraising activities such as grants, association membership fees, special events, or in-kind services, which are non-monetary contributions from individuals and organizations.

Below is a description and the environmental significance of some parameters typically sampled. New Hampshire Surface Water Quality Regulations are included where applicable to the following:

Temperature

Temperature is one of the most important and commonly observed water quality parameters. Temperature influences the rate of many physical, chemical and biological processes in the aquatic environment. Each aquatic species has a range of temperature and other factors that best support its reproduction and the survival of offspring. Temperature also impacts aquatic life because of its influence on other parameters, such as the concentration of dissolved oxygen in the water.

Temperature in Class B waters shall be in accordance with RSA 485-A:8, II, which states in part “any stream temperature increase associated with the discharge of treated sewage, waste or cooling water, water diversions, or releases shall not be such as to appreciably interfere with the uses assigned to this class.”

Dissolved Oxygen

Adequate oxygen dissolved in the water is essential to the survival and successful reproduction of many aquatic species. Fish and other organisms use gills to transfer oxygen to their blood for vital processes that keep them active and healthy. Oxygen is dissolved into surface waters from the atmosphere, aided only by wind and wave action at the surface and by tumbling over rocks and uneven terrain. Aquatic plants and algae do produce oxygen in the water, but this contribution is offset by decomposition and respiration. Bacteria use oxygen as they process (decompose) plants and other organic materials in the river into smaller particles, and many aquatic organisms use oxygen in the process of respiration (breathing). Because of these natural processes oxygen levels are constantly changing and reflect a combination of factors.

Oxygen concentrations in water are measured using a meter that produces readings for both milligrams per liter and percent saturation of dissolved oxygen (DO). For Class B waters, any single DO reading must be greater than 5 mg/L for waters meeting New Hampshire water quality standards. This means that in every liter of water there are at least five milligrams of dissolved oxygen available for ecosystem processes.

More than one measurement of oxygen saturation taken in a twenty-four hour period can be averaged to compare with water quality standards. Class B waters must have a dissolved oxygen content of not less than seventy five percent of saturation, based on a daily average, to satisfy aquatic habitat requirements. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Percent of saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the percent saturation has recovered to acceptable levels. Water can become saturated with more than one hundred percent dissolved oxygen, often observed below dams where the falling waters gather oxygen from the atmosphere.

There are other requirements in the New Hampshire administrative rules, Env-Ws 430, relative to cold water fish spawning areas, impoundments (dams), and reservoirs.

pH

pH is an indicator of hydrogen ion activity in water, measured on a logarithmic scale of zero to fourteen. The lower the pH, the more acidic the solution due to higher concentrations of hydrogen ions. A high pH is indicative of an alkaline or basic environment. Acid rain typically has a pH of 3.5 to 5.5. New Hampshire rivers have historically shown a range of pH values from 4.5 to 9. Most aquatic species require a

relatively stable pH between 5 and 9. The toxicity of aquatic compounds such as ammonia and certain metals is also affected by pH.

New Hampshire Surface Water Quality Regulations state that pH shall be between 6.5 and 8, unless naturally occurring. Often readings outside this range are determined to be naturally occurring because of the influence of wetlands near the sample site. In areas influenced by wetlands, tannic and humic acids released into the water by decaying plants can create acidic waters.

Conductivity

Conductivity is the numerical expression of the ability of water to carry an electric current. Formally termed specific conductance, conductivity is a measure of the free ion content in water. Water contains ions, or charged particles, such as magnesium (Mg^{2+}) and calcium (Ca^{2+}). These materials carry an electrical current and come from natural sources, such as soils and bedrock, or are introduced by human activity.

There is no standard for conductivity, because levels vary a great deal according to the geology of an area. Conductivity readings are useful in locating potential pollution sources because impacted surface waters usually have higher specific conductance than unimpacted waters. Conductivity tests can be used to indicate the potential presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, or aluminum ions, prior to any financial investment into analyzing specifically for these substances.

Turbidity

Turbidity is an indicator of the amount of suspended material in the water, such as clay, silt, algae, suspended sediment, and decaying plant material. A high degree of turbidity can interrupt the passage of light through the water and add heat to the water by absorbing sunlight. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events often contribute turbidity to surface waters by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters.

Class B waters shall not exceed naturally occurring conditions by more than ten turbidity units (NTUs). In order to determine compliance with the water quality standards, information about background turbidity levels is needed. Volunteer data can be used to supplement data already collected by DES to help determine if turbidity is a problem in a particular watershed.

Bacteria

Organisms causing infections or disease (pathogens) are excreted in the fecal material of humans and other warm-blooded animals. *Escherichia coli* (*E. coli*) bacteria is not considered pathogenic. *E. coli* is, however, almost universally found in the intestinal tracts of humans and other warm blooded animals and is relatively simple and

inexpensive to measure. For these reasons *E. coli* is used as an indicator of fecal pollution and the possible presence of pathogenic organisms.

In fresh water *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming. Class B waters shall contain no greater than 406 *E. coli* counts per one hundred milliliters CTS/100mL in any one sample, or not more than either a geometric mean based on at least three samples obtained over a sixty-day period of 126 *E. coli* (CTS/100mL).

Total Phosphorus

Phosphorus is a nutrient that is essential to plants and animals, but in excessive amounts it can cause rapid increases in the biological activity in water. This may disrupt the ecological integrity of streams and rivers.

Phosphate is the form of phosphorus that is readily available for use by aquatic plants. Phosphate is usually the limiting nutrient in freshwater streams, which means relatively small amounts of phosphate can have a large impact on biological activity in the water. Excess phosphorus can trigger algal blooms and aquatic plant growth. As a result, large amounts of decomposing organic material can decrease oxygen levels and the attractiveness of waters for recreational purposes.

Phosphorus can be an indicator of sewage, animal manure, fertilizer, erosion, and other types of contamination. There is no surface water quality standard for phosphorus due to the high degree of natural variability and the difficulty of pinpointing the exact source. However 0.05 mg/L total phosphorus is used as a level of concern, which means DES pays particular attention to readings above this level.

Metals

Depending on the metal concentration, its form (dissolved or particulate) and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on the pH of the water, as well as the presence of solids and organic matter that can bind with the metal and render it less toxic. Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. Higher hardness concentrations buffer the toxicity of certain metals. The metals standards are not detailed here due to their complexity.

Project Description

In 1998 the Lamprey River Watershed Association (LRWA) spearheaded the formation of a volunteer water quality monitoring program on the Lamprey River. Monitoring has been accomplished through a partnership among several groups with a strong interest in

the health of the river, local wildlife, aquatic recreation, and the educational opportunities the river offers us all. The LRWA and other watershed residents have monitored the river for two years and have been successful in expanding the sampling from Epping in 1998 to include Lee, Durham, and Newmarket in 1999. Refer to Appendix A for site locations and maps.

The Town of Epping has been very enthusiastic and supportive of the project, and the Rockingham Waste Water Treatment Facility provided analysis of samples for the group in 1998. Great Bay Coast Watch, an established estuarine citizen monitoring program, also supported the initiation of sampling activities with middle school students in Epping. Epping Middle School acquired a grant from the New Hampshire Estuaries Project (NHEP) to purchase monitoring equipment. The students and a few dedicated teachers have used the VRAP data collected during the summer to supplement testing done by the students in the spring and fall.

Results and Discussion

Data tables and graphs are located in Appendix C. VRAP baseline parameters and bacteria results are reported by site, from upstream to downstream, in this section. Under each parameter heading (i.e. "Bacteria") there is a code for the site indicating the number of samples collected that year and the number of samples that did not meet the water quality standard, where applicable. For example, if there were twelve samples collected at a site in 1999 and nine of them did not meet standards, the code would read as follows: "1999-12-9". Where there is no standard but a level of concern had been designated by DES, a narrative description of the conditions is given.

16a-Lmp. John B. Folsom Conservation Area, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

Dissolved oxygen (DO) samples measured above the required minimum instantaneous concentration of 5 mg/L DO, ranging from 6.83 to 10.7 mg/L. All of the samples had at least 75% saturation, meeting the criteria that support a healthy aquatic ecosystem.

1999-10-0 (< 5 mg/L minimum)

The dissolved oxygen concentrations in 1999 ranged from 6.13 to 9.79 mg/L, all above the 5 mg/L minimum. The DO ranged between 68 and 108%. The DO was 68% saturation on August 7, 1999, which is below the state standard. This reading suggests that for at least part of the day the river may not be meeting the criteria that support a healthy aquatic ecosystem. Additional information about the daily average percent saturation of dissolved oxygen is needed to determine whether or not the river is meeting the state standard at this location.

pH

1998-6-1 (unless naturally occurring)

The pH values recorded at 16a-Lmp ranged from 6.37 to 8.35. One of these measurements was below the standard range for pH (6.5 to 8).

1999-10-3 (unless naturally occurring)

Three measurements in 1999 were below 6.5, ranging from 6.0 to 7.67.

Natural causes such as drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in this river segment. Additional investigations into the drainage area are necessary to determine the cause of the low pH measurement.

15a-Lmp. Mary Folsom Blair Community Park, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

All samples collected met the minimum requirements of the New Hampshire Surface Water Quality Regulations.

15a-Lmp is located below a dam where the river is picking up oxygen from spilling over the dam. This site was not sampled in 1999. Monitoring resources were reallocated, allowing the sampling to be expanded beyond the community of Epping.

pH

1998-6-0 (unless naturally occurring)

The pH values recorded at 15a-Lmp ranged from 6.59 to 7.33, within the standard range for Class B waters.

13a-Lmp. Epping Town Hall, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

The DO concentrations at this location ranged from 7.46 to 9.66 mg/L and percent saturation ranged from 86 to 108%. All samples met the minimum state standards.

This site was not chosen for sampling in 1999. This location on the river exhibited no obvious impairments of water quality. Monitoring resources were reallocated, allowing the sampling to be expanded beyond the community of Epping.

pH

1998-6-0 (unless naturally occurring)

The pH values recorded at 13a-Lmp ranged from 6.71 to 7.25, all within the standard range of values.

13'-Lmp. Mill Street Bridge, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

The DO concentrations at this location ranged from 7.44 to 10.59 mg/L, all above the minimum instantaneous concentration of 5 mg/L.

1999-10-0 (< 5 mg/L minimum)

The DO samples in 1999 ranged from 5.26 to 10.08 mg/L. Extremely dry, low-flow conditions contributed to four of the ten samples not meeting the minimum 75% saturation requirement. Dissolved oxygen measurements ranged from 58.9 to 97% saturation. These readings suggest that this river segment may not be meeting the criteria that support a healthy aquatic ecosystem. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen percent of saturation standard at this location.

pH

1998-6-0 (unless naturally occurring)

The pH values recorded ranged from 6.71 to 7.44, well within the range of standard values for Class B waters.

1999-10-5 (unless naturally occurring)

pH values ranged from 5.82 to 7.65. Five of the measurements were below the standard range for pH (6.5 to 8). Drainage from non-point sources in the nearby watershed may be affecting the pH levels in this river segment. Additional investigations into the drainage area are necessary to determine the cause of the low pH levels.

Bacteria

1998-2-1

Bacteria samples were collected by volunteers and analyzed for *E. coli* bacteria twice in 1998. On September 17, 1998, the sample collected contained 420 *E. coli* CTS/100mL, exceeding the maximum of 406 *E. coli* CTS/100mL. The sample from 13'-Lmp had 335 *E. coli* CTS/100mL on August 28, 1998. Samples taken by volunteers and the Ambient sampling program a short distance upstream at the Epping Town Hall (13-Lmp) met the

bacteria standard and ranged from 50 to 100 *E. coli* CTS/100mL. Additional investigations into the source and concentration of bacteria at this location are necessary.

12b-Lmp. Epping WWTF Upstream, Epping, NH:

Dissolved Oxygen

1998-3-0 (< 5 mg/L minimum)

The DO concentrations at 12b-Lmp ranged from 7.52 to 9.47 mg/L, all above the minimum instantaneous concentration of 5 mg/L.

1999-10-0 (< 5 mg/L minimum)

The DO concentrations ranged from 5.05 to 9.80 mg/L in 1999.

Five of the ten samples did not meet the minimum 75% saturation standard, ranging from 56 to 97% saturation. These readings suggest that the river may not be meeting the criteria that support a healthy aquatic ecosystem. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen percent of saturation standard at this location.

pH

1998-3-0 (unless naturally occurring)

The pH values recorded in 1998 at 12b-Lmp ranged from 7.02 to 7.14, all within the standard range of pH values for Class B waters.

1999-10-2 (unless naturally occurring)

The pH values recorded in 1999 were between 6.3 and 7.56. Two of the measurements taken were below the standard range for pH (6.5 to 8). Drainage from the nearby watershed may be affecting the pH levels in this river segment. Additional investigations into the drainage area are necessary to determine the cause of the low pH levels.

Bacteria

1998-2-1

On September 17, 1998, the bacteria sample collected at 12b-Lmp measured 973 *E. coli* CTS/100mL, exceeding the maximum concentration of 406 *E. coli* CTS/100mL. The sample from 12b-Lmp had only 80 *E. coli* CTS/100mL on August 28, 1998. The high degree of variability among the readings indicates that the bacteria may be caused by natural conditions such as transient wildlife populations or wet weather washing materials containing bacteria into the river at this location. Additional investigations into the source and concentration of bacteria at this location are necessary.

12a-Lmp. Epping WWTF Downstream, Epping, NH:

Dissolved Oxygen

1998-4-0 (< 5 mg/L minimum)

All samples measured were above the required minimum instantaneous concentration of 5 mg/L, ranging from 7.11 to 8.35 mg/L. This location on the river met the state recreational DO standard in 1998.

1999-10-2 (< 5 mg/L minimum)

Two of the ten DO measurements in 1999 were below the required minimum of 5 mg/L, ranging from 4.56 to 10 mg/L. This river segment did not meet the state DO standard. Six of the ten measurements were below 75% saturation, ranging from 54 to 96% saturation. These readings suggest that for most of the summer this river segment may not be meeting the criteria that support a healthy aquatic ecosystem. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1998-4-0 (unless naturally occurring)

The pH values recorded in 1998 at 12a-Lmp were within the standard range for Class B waters, ranging from 6.93 to 7.53.

1999-10-2 (unless naturally occurring)

Two out of ten measurements recorded in 1999 were below the standard range for pH, ranging from 5.72 to 7.53. Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in this river segment.

Bacteria

1998-2-1

On September 17, 1998, the bacteria sample collected contained 887 *E. coli* CTS/100mL, exceeding the state bacteria standard. The sample from 12a-Lmp had only 60 *E. coli* CTS/100mL on August 28, 1998. Additional sampling and weather information is necessary to determine the cause of the elevated bacteria levels measured at this site. The high degree of variability among the readings indicates that the bacteria may be caused by natural conditions such as transient wildlife populations or wet weather washing materials containing bacteria into the river at this location.

12-Lmp. Route 87 Bridge, Epping, NH:

Dissolved Oxygen

1998-5-0 (< 5 mg/L minimum)

All samples measured above the minimum concentration of 5 mg/L, ranging from 7.14 to 9.2 mg/L. This river segment met the state DO standard in 1998.

1999-10-2 (< 5 mg/L minimum)

The DO concentrations at this location ranged from 3.9 to 9.96 mg/L and percent saturation ranged from 44 to 96%. Seven of the nine measurements were below 75% saturation. These readings suggest that for most of the summer this river segment may not be meeting the criteria that support a healthy aquatic ecosystem. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1998-5-0 (unless naturally occurring)

The pH values recorded at 12-Lmp ranged from 6.66 to 7.1, within the standard range for Class B waters.

1999-10-3 (unless naturally occurring)

The pH values recorded at 12-Lmp ranged from 6.12 to 7.68 in 1999. Three of these measurements were below the standard range for pH. Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river here.

Nutrients

Total phosphorus samples were collected three times in 1998 at 12-Lmp, ranging from 0.029 mg/L to 0.4 mg/L.

In 1999 two total phosphorus samples were collected, measuring 0.04 mg/L and 0.079 mg/L. Runoff from nearby wetland areas may be contributing to the elevated total phosphorus results at this site.

Metals

2-1

Samples for total metals analysis were collected twice in 1998 and analyzed for the concentration of four metals: aluminum, copper, lead and zinc. One of the measurements was above the acute limit for Zinc in Class B waters (0.0354 mg/L).

11b-Lmp. George Falls Woods, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

All dissolved oxygen measurements at this site met the requirements of the New Hampshire Surface Water Quality Regulations.

This site was not sampled in 1999. Monitoring resources were reallocated, allowing the sampling to be expanded beyond the community of Epping.

pH

1998-6-0 (unless naturally occurring)

The pH values recorded in 1999 at 11b-Lmp ranged from 6.65 to 7.3, within the standard range for Class B waters.

11a-Lmp. Camp Lee Road, Epping, NH:

Dissolved Oxygen

1998-6-0 (< 5 mg/L minimum)

All samples measured above the required minimum instantaneous concentration of 5 mg/L, ranging from 6.91 to 10.86 mg/L.

pH

1998-6-0 (unless naturally occurring)

The pH values recorded in 1999 ranged from 6.63 to 7.25, within the standard range for Class B waters.

This site was not sampled in 1999. Monitoring resources were reallocated, allowing the sampling to be expanded beyond the community of Epping.

11-Lmp. Wadley Falls, Lee, NH:

Dissolved Oxygen

1999-9-0 (< 5 mg/L minimum)

All samples measured above the required minimum instantaneous concentration of 5 mg/L, ranging from 5.1 to 9.56 mg/L.

One of the nine measurements was below 75% saturation, ranging from 58 to 90.9% saturation. This data suggests that this river segment may not meeting the DO criteria that support a healthy aquatic ecosystem at all times. Additional information about the

daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1999-9-1 (unless naturally occurring)

The pH values recorded ranged from 6.3 to 7.64. One of these measurements was below the standard range for pH (6.5 to 8). Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river here.

09-Lmp. Lee Hook Road, Lee, NH:

Dissolved Oxygen

1999-10-1 (< 5 mg/L minimum)

Out of ten samples measured nine were above the required minimum instantaneous DO concentration of 5 mg/L, ranging from 4.49 to 9.54 mg/L.

One of the ten measurements, ranging from 51 to 98%, was below 75% saturation. These data suggest that this river segment may not meeting the DO criteria that support a healthy aquatic ecosystem at all times. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1999-10-2 (unless naturally occurring)

The pH values recorded ranged from 5.84 to 7.65. Two of these measurements were below the standard range for pH (6.5 to 8). Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river here.

08-Lmp. Wiswall Dam Swimming Area, Durham, NH:

Dissolved Oxygen

1999-10-1 (< 5 mg/L minimum)

Out of ten samples measured nine were above the required minimum instantaneous DO concentration of 5 mg/L, ranging from 4.89 to 10.28 mg/L.

One of the ten measurements, ranging from 57 to 92%, was below 75% saturation. These data suggest that this river segment may not meeting the DO criteria that support a healthy aquatic ecosystem at all times. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1999-10-4 (unless naturally occurring)

The pH values recorded ranged from 5.87 to 7.43. Four of these measurements were below the standard range for pH (6.5 to 8). Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river at this location.

5a-Lmp. 220 Newmarket Road, Durham, NH:

Dissolved Oxygen

1999-10-1 (< 5 mg/L minimum)

One of the ten samples measured below the required minimum 5 mg/L dissolved oxygen, ranging from 4.74 to 10.6 mg/L.

Five of the ten measurements were below 75% saturation, ranging from 55 to 104% saturation. This data suggests that this river segment is not meeting the DO criteria that support a healthy aquatic ecosystem at all times. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen percent of saturation standard at this location.

pH

1999-10-4 (unless naturally occurring)

The pH values recorded ranged from 5.78 to 7.47. One of the ten measurements was below the standard range for pH. Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river here.

05-Lmp. Route 108 Bridge, Newmarket, NH:

Dissolved Oxygen

1999-10-1 (< 5 mg/L minimum)

Out of ten samples measured nine were above the required minimum instantaneous DO concentration of 5 mg/L, ranging from 4.82 to 10.66 mg/L.

One of the ten measurements, ranging from 56 to 97%, was below 75% saturation. These data suggest that this river segment may not meeting the DO criteria that support a healthy aquatic ecosystem at all times. Additional information about the daily average percent of saturation is needed to determine whether or not the river is meeting the dissolved oxygen standard at this location.

pH

1999-10-6 (unless naturally occurring)

The pH values recorded ranged from 5.43 to 7.43. Six of these measurements were below the standard range for pH (6.5 to 8). Drainage from wetland areas and non-point sources in the nearby watershed may be affecting the pH levels in the river at this location.

Recommendations

After reviewing the data from the Lamprey River, VRAP recommends the following actions:

- Further investigation through shoreline surveys will augment existing data by providing information about potential sources of impacts to river quality. The location of runoff, wetland areas, areas lacking vegetated buffers, and the characteristics of the land adjacent to the river will help determine the cause of the exceedences of water quality standards. This information may then be used to correct problems that are not naturally occurring.

Shoreline surveys could be conducted near stations 16a-Lmp, 13a-Lmp, 13'-Lmp, 12b-Lmp, 12a-Lmp, 12-Lmp, 11-Lmp and 5a-Lmp to determine the cause of low pH and DO measurements, as well as the high total phosphorus and zinc concentrations measured at 12-Lmp. Total phosphorus inputs to the river may be reduced by creating or replacing vegetated buffers along the riverbank and diverting runoff into these buffer areas. The shoreline surveys will help determine where these remedies might be applied.

- VRAP suggests the use of Hydrolab® meters at locations in the watershed that exhibited low DO levels. A Hydrolab® is a meter that is deployed for a period of days, weeks, or months in the river to measure many parameters simultaneously and at set time intervals. This information will help determine if the daily average values of dissolved oxygen are supporting aquatic habitat and if the river segment is meeting surface water quality regulations. The multi-parameter meters can also be placed above and below a suspected pollution source to help determine the impact.

VRAP can loan these multi-parameter meters, and suggests placing them at 16a-Lmp, 13a-Lmp, 13'-Lmp, 12b-Lmp, 12a-Lmp, 12-Lmp, 11-Lmp and 5a-Lmp in the summer of 2000. A Hydrolab® may also be placed in tributaries to the Lamprey River to produce additional information about the quality of the water coming into the main stem of the river.

- Additional investigations into sources of bacteria in the watershed are recommended 13'-Lmp, 12b-Lmp, 12a-Lmp and 12-Lmp, where bacteria violations were documented. Relationships with municipalities and other

volunteer monitoring groups in the watershed should be cultivated to accomplish bacteria analysis at a local laboratory. Volunteers seeking additional experience with analyzing water samples may consider offering to work in a municipal lab filtering and incubating samples. VRAP is capable of providing equipment that may be necessary to accommodate the extra sample load in a local laboratory.

- Reducing phosphorus inputs to the river can be accomplished by public education and outreach in the watershed. Waste Water Treatment Facilities (WWTFs) discharge phosphorus-laden waters to the river. If the communities connected to a municipal waste disposal system reduce the amount of phosphorus they discharge to the WWTF, there would be less discharged to the river. The DES Pollution Prevention Program can provide educational guidance for groups wishing to do outreach related to waste reduction.
- Volunteers can investigate the conditions behind the impoundments on the river and determine if the water meets water quality standards by measuring dissolved oxygen at several locations and depths behind dams. The top 25% of the water depth behind a dam in New Hampshire is required to have a daily average of at least 75% saturation. Measurements recorded by the volunteers suggest that the river may not be meeting the required DO criteria. Investigations of the impoundments in the watershed will help DES determine if standards are being met.
- VRAP encourages the continuation of the effort to monitor baseline conditions in the Lamprey River. The coastal watersheds in New Hampshire are priority areas in the state for watershed evaluation, preservation and restoration activities. The sampling that has already taken place has helped create the recommendations in this report. Additional sampling will augment the data collection and river management efforts of DES, as well as those of local decision makers.
- Results generated by volunteers indicate that water quality may not be fully supporting the designated uses above the treatment plant. Non-point investigations above the WWTF will help determine the sources of these impairments and restoration projects above the WWTF may help the river assimilate the WWTF discharge.
- VRAP recommends that the Lamprey river volunteers expand partnerships with schools in the watershed and continue to contribute to the water quality education of watershed residents through outreach initiatives.
- DES expects annual allocations of federal funds through the Clean Water Action Plans program created under President Clinton's administration. These funds can be used to implement restoration projects that address degraded waters found throughout the coastal watersheds. All volunteer groups in the 43 seacoast communities are encouraged to develop restoration projects. The New Hampshire Estuaries Project Management Plan is an excellent source of project ideas and

DES is available to assist watershed groups in developing projects. Contact Natalie Landry, Coastal Watershed Supervisor at 271-5329 for assistance.